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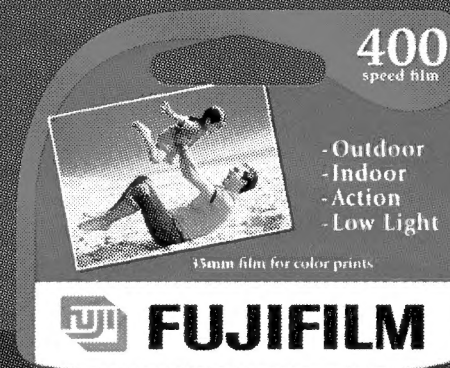
**INSIDE:**

A Przewalski's Horse  
and a Giant Panda  
Cub Arrive at the Zoo

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## Partners in Conservation Education

Among the best recognized, but rarest animals in the world, giant pandas have come to symbolize endangered species and international conservation efforts. In an effort to help protect the giant pandas and secure their future, Fujifilm is proud to be the lead corporate sponsor of the Zoo's giant panda program.

Fujifilm's support helped the National Zoo bring giant pandas Mei Xiang and Tian Tian to Washington, and is assisting the Zoo's experts to develop the scientific knowledge they need to ensure the survival of pandas in the wild. Fujifilm also supports comprehensive conservation education programs designed to help children and adults learn more about giant pandas and the conservation of all wildlife and their habitats.

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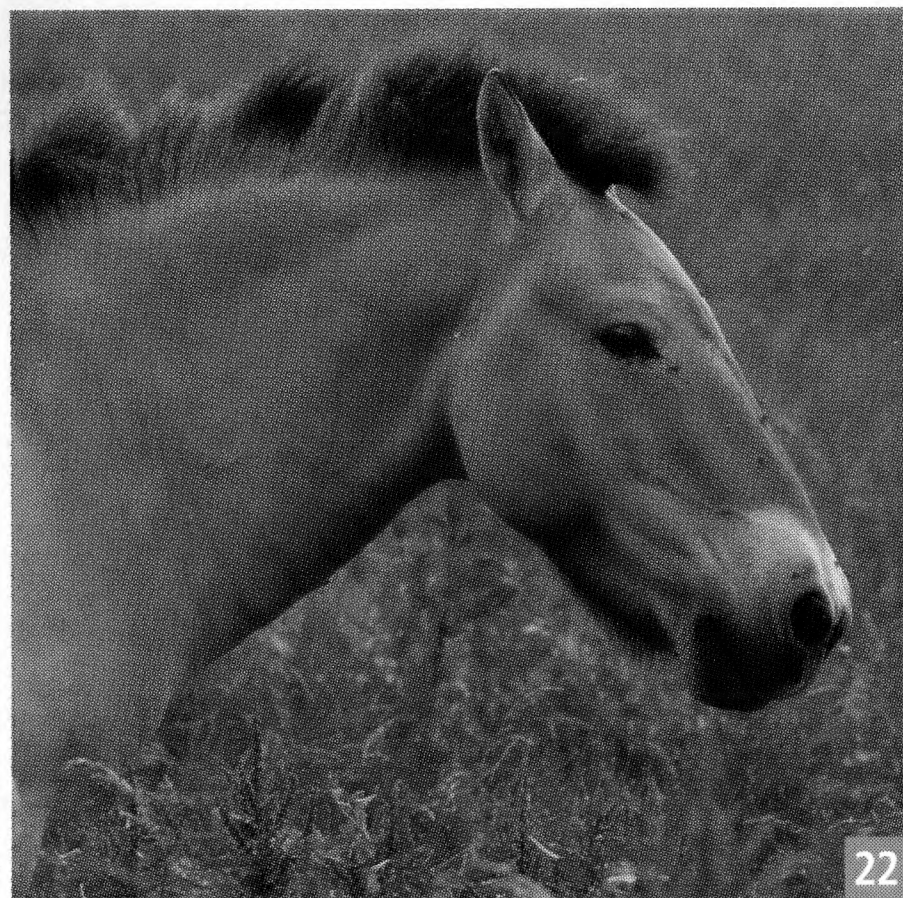
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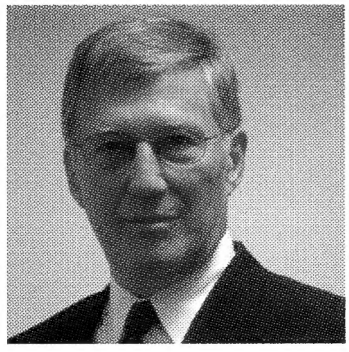
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## FONZForum

July 9, 2005, will forever be a celebrated day in the history of the Smithsonian's National Zoo. In the early hours of that day, giant pandas Mei Xiang and Tian Tian became the parents of a vigorous cub and, within minutes, the news flashed around the world. And the next day, when our panda cams went live again, it seemed as if the whole world wanted to take a peek at Mei and her newborn. Countless FONZ members and well-wishers called or sent notes of congratulation. Thanks to all of you for sharing our delight in this momentous birth and for your continued interest in following the cub's progress. As each day goes by, we're ever more hopeful that a healthy cub will soon make its public debut to a host of admiring Zoo visitors.

At a time when zoos everywhere are under attack by extremists who would like to take away your ability to see wonderful animals from faraway places, our new cub—and the public's excitement about it—are positive proof of the value of zoos. The National Zoo, along with other AZA-accredited zoos, is committed to the conservation of endangered species like the giant panda. Successful conservation depends on good science, much of which can only be done with giant pandas living in zoos. For example, National Zoo scientists have been studying the reproductive biology of giant pandas in zoos for many years. The knowledge they have amassed enabled them to perform the artificial insemination that led to Mei's pregnancy and then to monitor her behavior and hormone levels to predict the timing of the cub's birth. This research would be impossible to conduct on pandas in the wild.

Equally important, successful conservation also depends on people who care, and who are inspired by seeing and getting to know the magnificent species with which they share the planet. Yet, very few people will ever see a giant panda in the wild—even field biologists who study giant pandas in China only rarely get a glimpse of these secretive bears. Since 1972, when Ling-Ling and Hsing-Hsing first came to the United States, the National Zoo has been revealing the wonders of giant pandas to millions of people who might otherwise have been unaware of their very existence. The giant pandas living here are ambassadors for giant pandas living in the wild. These bears inspire people to care about the future of giant pandas and take action to help protect not only pandas and their habitats, but wildlife and wild lands everywhere.

As members, you can be proud of FONZ's contributions to the Zoo's giant panda conservation program. Your support and the support of lead corporate sponsor Fujifilm and exclusive media sponsor Animal Planet make much of this work possible. FONZ helps fund the research of Zoo scientists, which led to the birth of our cub and is also enhancing our understanding of what the giant panda needs to survive and thrive both in zoos and in the wild. Education programs, such as our online curriculum Conservation Central, offer information people can use to make a difference to the future of giant pandas. At the Zoo, FONZ volunteers talk to visitors about giant pandas and assist Zoo scientists by collecting behavioral observations; one lucky volunteer on the 24-hour panda pregnancy watch had the thrilling opportunity to witness the cub's birth! And the opening next summer of an expanded Fujifilm Giant Panda Habitat will ensure that our cub, and the cubs we hope for in the future, have plenty of space to play.

For now, Mei and her cub remain secluded from public view except via the web cams, which offer close-up views of tender interactions between mom and baby and a great way to follow the cub's early growth and development. Soon, if all continues to go well, we will announce special opportunities for FONZ members to preview mother and cub's outdoor debut. Please watch the website for details, and plan to join us in celebrating the birth of a giant panda at the National Zoo.

I would also like to welcome John Berry, the new Director of the National Zoo, and look forward to working with him to make the Zoo an even better place for our members, visitors, staff, and, most important, our animals. Please plan to attend the FONZ annual meeting on October 14 to meet John and hear about his exciting vision for the Zoo's future. See page 7 for details.

It's a great time to be a Friend of the National Zoo!

Sincerely,

James M. Schroeder  
Executive Director

P.S. Voting to elect members of the FONZ Board of Directors is underway. Please watch your mailbox for a ballot. The deadline for casting your vote is October 7.



is a nonprofit organization dedicated to supporting the conservation, education, and research efforts of the Smithsonian's National Zoo. Formed in 1958, FONZ was one of the first conservation organizations in the nation's capital. Friends of the National Zoo is dedicated to supporting the National Zoo in a joint mission to study, celebrate, and protect the diversity of animals and their habitats.

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ZooGoer (for those outside a 200-mile radius of Washington, D.C.)	\$25 (\$8 of membership dues goes to a ZooGoer subscription)

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**Cover photo:** A Przewalski's horse at the Smithsonian National Zoo's Conservation and Research Center. Photo by Jessie Cohen/NZP.



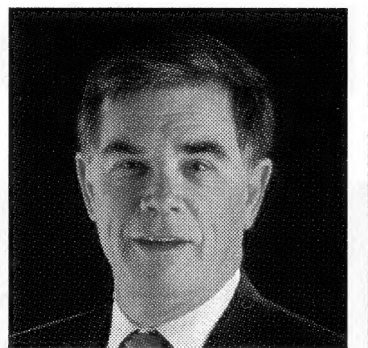
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## Letter from David L. Evans



### Two Exciting New Arrivals at the National Zoo

On July 9, very early in the morning, I was awakened by the ring of my cell phone. Hearing the long-awaited news—Mei Xiang had given birth—I shrugged off my pre-dawn drowsiness and began to hope and worry in about equal measure. Like those of a new parent, my feelings swung between elation and trepidation. Staff reported that the newborn appeared healthy, but we all knew that something could go wrong. The birth of a giant panda anywhere is news; the birth of a giant panda at the Smithsonian's National Zoo is NEWS! Mother and baby would be peered at through the microscopes of people the world over and, as always, the entire Zoo would be under intense scrutiny.

Happily, as we go to press, I am optimistic that our panda cub will continue to thrive. And while all attention is on the growing cub and his attentive mom, I would like to put the spotlight on the less-visible efforts of the people who are part of what we often call the "hidden zoo." Animal-care staff, veterinarians, and scientists have worked for years to acquire the knowledge necessary to get to this birth. But as important as our cub is, he represents just one small step in our comprehensive scientific program to ensure a future for giant pandas.

Many of you know that our panda cub was conceived via artificial insemination. The Beijing Zoo pioneered this technique in giant pandas, producing a cub in 1978, but the procedure's success was highly inconsistent. Starting in 1998, National Zoo scientists teamed up with Chinese colleagues to gain a better understanding of the reproductive biology of the species. Among other advances, our scientists developed fast, noninvasive ways to measure reproductive hormones in giant panda urine. Because changes in certain hormone levels predict ovulation, this information is critical, both for timing mating encounters and for performing artificial insemination at precisely the right time. This is how our scientists successfully artificially inseminated Mei Xiang; recently, this same strategy was used to breed 15 females at the Chengdu Zoo, one of our partner breeding centers in China. Hormone monitoring also enabled staff to predict when Mei Xiang might give birth so everyone was ready to watch and intervene if necessary.

Successful breeding also depends on zoo pandas enjoying good nutrition and physical health. Working with Chinese colleagues and others, our scientists helped improve the nutrition and veterinary care of pandas. All of this has resulted in an increase in giant panda numbers. In 1998, 104 giant pandas lived in Chinese zoos and breeding centers. Today, the population stands at 142, and growing! Zoo scientists are also advising on the genetic management of zoo pandas to minimize inbreeding and keep the population genetically vigorous.

The excitement surrounding panda births in zoos, however, must be tempered with understanding that the ultimate survival of the species depends on maintaining viable wild populations of pandas and conserving their habitat in China. For this reason, our scientists are conducting field studies to map panda habitat and to document the presence of giant pandas and other wildlife in remote reserves. Perhaps most important, our scientists are mentoring and training the next generation of Chinese

conservation biologists in varied disciplines ranging from cryobiology and small population biology to the use of geographical information systems (GIS) to map habitat. In the last five years alone, more than 450 professionals have benefited from courses the Zoo offered in China.

As I've learned in the past months of serving as the Interim Zoo Director, and as this brief overview of our giant panda program hints, the National Zoo is a highly complex, multi-faceted organization. The Zoo Director oversees more than 2,000 individual animals, dozens of keepers, curators, scientists, and veterinarians devoted to caring for them, and many others working to offer nearly two million annual visitors inspiring and enjoyable experiences here. The Director leads and champions the efforts of Zoo scientists to study and conserve endangered species in our Zoo, in zoos worldwide, and in the wild, from Chinese mountains and African savanna to North American forests and deserts. The Zoo and its Conservation and Research Center campus are like small cities, with old facilities to repair, and new ones to build. Perhaps most important and also most challenging, the Director assembles and manages the financial resources needed to support all of these activities. And, because the National Zoo, as part of the Smithsonian Institution, is the nation's zoo and an international leader, our every action is scrutinized. So, just as a giant panda cub born here is NEWS, so too is our announcement of the next Director of the National Zoo. On October 1, I will turn over the keys to the park to John Berry.

John's extensive management, public policy, and wildlife conservation experience is a tremendous asset to the Zoo. Most recently, he was executive director of the National Fish and Wildlife Foundation, a congressionally chartered nonprofit organization dedicated to conserving the nation's wildlife resources. Previously, he was the Interior Department's assistant secretary for policy, management and budget; he increased that agency's budget from \$7 billion to \$10 billion, and developed a presidential conservation initiative known as the "Lands Legacy." John also understands the Smithsonian and its mission: As director of government and relations and a senior policy advisor of the Smithsonian from 1995 to 1997, he worked on the National Museum of the American Indian and the National Air and Space Museum's Hazy Center. In addition to these and other qualifications too numerous to list here, John has a great enthusiasm for the Zoo's science programs and a lifelong love of the Zoo and its animals.

I have thoroughly enjoyed serving as Interim Zoo Director. I am equally happy, however, to return to being Under Secretary for Science full-time. I am confident that the National Zoo will flourish under John's leadership, and look forward to its brilliant future.

Sincerely,

David L. Evans

Under Secretary for Science, Smithsonian Institution,  
and Interim Director of the Smithsonian's National Zoological Park



# Notes&News



A video still of Mei Xiang and her cub, taken July 10.

## A Cub is Born

Just five days after Washington, D.C., celebrated the anniversary of the birth of the United States, the Smithsonian's National Zoo celebrated a long-awaited birth of a very different sort. On July 9, 2005, giant panda Mei Xiang delivered her first baby, also the first **giant panda** cub (*Ailuropoda melanoleuca*) born at the Zoo in 16 years.

Mei Xiang and her mate Tian Tian are the Zoo's second pair of giant pandas. They were both born in China and are here on a ten-year loan from the Chinese government in exchange for our contribution of \$10 million to China's efforts to save giant pandas in the wild. This amount was raised from private donors, including our lead corporate sponsor Fujifilm and our exclusive media sponsor Animal Planet. When the pandas debuted at the Zoo in January 2001, Mei was 2½ years old and Tian was 3½.

Mei and Tian mated for the first time in 2003, but that year and the next passed without a pregnancy. In 2005, Mei's fertile period, which lasts only a few days each year, began in March. Although Mei and Tian showed promising mating behavior, the pandas failed to copulate.

Armed with a backup plan and a great deal of expertise, Zoo scientists used data from studies they pioneered to calculate the optimal time to artificially inseminate Mei. On March 11, Zoo reproduction scientists and veterinarians anesthetized her and injected Tian's sperm directly into her uterus. But there was no way to determine if Mei were pregnant: A fertilized giant panda egg does not develop into a fetus until it implants on the uterine wall, which may take up to four months. And although Zoo scientists actively monitored Mei Xiang's hormones throughout the gestation period, which may last as long as 185 days, her progesterin levels would rise and fall in the same pattern whether she was experiencing a real pregnancy or a pseudopregnancy. Months of watching and waiting lay ahead.

Almost everything Mei did was observed, recorded, and analyzed as her gestation drew to a close. Starting in mid-June, FONZ volunteers watched a bank of video monitors that displayed a live feed of Mei no matter where she was in the Fujifilm Giant Panda Habitat, thanks to 23 video cameras placed throughout the indoor and outdoor enclosures. The volunteers

watched Mei for signs of maternal behavior, and as her progesterin levels peaked toward the end of June, the volunteer pregnancy watch expanded to 24 hours a day. The volunteers began to see Mei cradling objects and nest building.

Yet for all the anticipation of a birth, only two people were on hand to witness it on July 9. Giant panda keeper Brenda Morgan and FONZ behavior watcher Susan Hughes sat in front of the video monitors, riveted by Mei Xiang's unusual restlessness and her frequent pants and grunts. Finally, at 3:41 a.m., months of anxious waiting ended in one triumphant moment, and the pig-like squeals of a newborn filled the air.

Suzan Murray, head Zoo veterinarian, and Lisa Stevens, assistant curator, hurried in and looked for glimpses of the tiny cub on the video monitors. Would Mei Xiang, a first-time mother, know how to handle the fragile baby that was only 1/900 her size, or would she be frightened and abandon it? While human mothers-to-be consult doctors, friends, and baby books to prepare for their little ones' arrival, she had only her instincts to guide her. Luckily, motherhood came naturally to Mei. Two minutes after the birth, she picked up the squirming cub, cradled it in her arms, and gently licked it clean.

Mei had passed an important milestone but she still had much to learn, and the cub would be vulnerable for months to come. Born hairless and helpless, it probably weighed less than six ounces and would not open its eyes until it was between four and six weeks old.

To avoid disturbing the pandas and to give them time to bond, the Zoo staff adopted a hands-off approach in the beginning, opting to intervene only if the cub showed signs of distress or Mei stopped caring for it. Mei Xiang proved an attentive and gentle mother.

On August 2, Zoo veterinarians examined the cub for the first time and announced that it is a thriving male! It was a happy occasion for the Zoo and for Mei and her firstborn, and if all goes well, there are many more to come. Although the cub is still vulnerable, plans are underway for his naming and debut. According to Chinese custom, the cub will be named 100 days after his birth, and after he is about three months old, he and Mei Xiang will emerge from their private indoor enclosure, where they are currently off exhibit, to meet the thousands of visitors eager to welcome the cub into the world.

In the meantime, you can watch the cub on the Zoo's online panda cams at [www.fonz.org/giantpandas.htm](http://www.fonz.org/giantpandas.htm), or visit his father, Tian Tian, at his outdoor exhibit. None of the hullabaloo seems to bother Tian—a typical giant panda father, he does not participate in rearing the cub.

The cub's birth symbolizes a baby step toward restoring the worldwide population of endangered giant pandas. As development and other human activities claim their native habitat in central China, giant panda numbers are decreasing—currently, about 1,600 survive in the wild, 160 in Chinese breeding facilities and zoos, and about 20 in zoos outside China.

The National Zoo is committed to giant panda conservation and research, both at the Zoo and in China. Zoo scientists work to better understand giant pandas' biology in hopes of improving the health and reproductive success of pandas in zoos and protecting populations of giant pandas and their habitat in the wild. Their research helped improve the efficiency of artificial insemination procedures, including the one used on Mei Xiang.

Her cub may one day carry the Zoo's legacy of giant panda conservation back to his parents' birthplace. In the wild, giant panda cubs typically separate from their mothers between 18 and 24 months of age; when he turns two, Mei's cub will likely return to China to bolster the breeding population there.



## Events

### Fiesta Musical

September 18—11 a.m. to 5 p.m.

FONZ celebrates Hispanic Heritage Month with a free annual Fiesta at the National Zoo. With animal encounters, Latino music, costumed dancers, traditional crafts, and Latin American foods, the event offers something for everyone. For more information, visit [www.fonz.org/fiesta.htm](http://www.fonz.org/fiesta.htm).

### Autumn Conservation Festival

October 1 and 2—10 a.m. to 3 p.m.

Once a year, the Zoo's Conservation and Research Center (CRC) in Front Royal, Virginia, opens its gates to give you a behind-the-scenes peek at the Zoo's endangered species conservation programs. Your family will enjoy guided tours of the veterinary hospital and animal breeding facilities, meet scientists and keepers and learn about the tools they use, and hear live music. Lunch and beverages will be sold on the grounds. Free admittance to FONZ-CRC members and \$25 for FONZ members and the public. For more information or to add CRC to your FONZ membership, visit [www.fonz.org/crc tour.htm](http://www.fonz.org/crc tour.htm).



### FONZ Annual Meeting

October 14—6 to 8 p.m.

All FONZ members are invited to attend this year's annual meeting at the Visitor Center. At the 6 p.m. wine and cheese reception, you can meet and greet FONZ Board members and receive 25 percent off purchases at the National Zoo Bookstore. The meeting begins at 7 p.m. FONZ Board President Mark Handwerger will give a state of FONZ address and introduce the new Director of the National Zoo and new FONZ Board members and officers.

### Boo at the Zoo

October 28, 29, and 30—5:30 to 8:30 p.m.

Bring your little ghosts and goblins to trick-or-treat the night away at the wildest Halloween party in town. Boo at the Zoo features more than 40 treat stations, not-too-scary haunted trails, and animal encounters. A free shuttle will run between the Zoo and the Woodley Park-Zoo/Adams Morgan Metro station between 5 and 9 p.m. Tickets will go on sale online on September 1 at [www.fonz.org/boo.htm](http://www.fonz.org/boo.htm). They cost \$13 for FONZ members and \$23 for nonmembers.



### Lecture: *The Race to Save the Lord-God Bird*

September 13—Book signing at 7 p.m., lecture at 7:30 p.m.

Phillip Hoose of The Nature Conservancy will sign copies of his new book and talk about a very timely subject—the ivory-billed woodpecker. Hoose explores how this enigmatic bird dwindled to extinction, or so it was thought: The species was rediscovered in the spring of 2005.

### Lecture: *Tigerland and Other Unintended Destinations*

October 6—Book signing at 7 p.m., lecture at 7:30 p.m.

Eric Dinerstein of World Wildlife Fund-U.S. will sign and talk about his new book, which traces his journey to conservation's frontiers, from early research in Nepal to recent expeditions to remote wild areas around the world.

## FONZ's 2005 Giant Panda Photo Contest

Congratulations to the winners of the FONZ Giant Panda Photo Contest, and thanks to the contest's sponsors, Fujifilm, *Washington Families* magazine, *The Washington Examiner*, and 97.1 WASH-FM. Amateur photographers submitted 278 entries in four categories. Entries were judged on creativity, composition, and content.



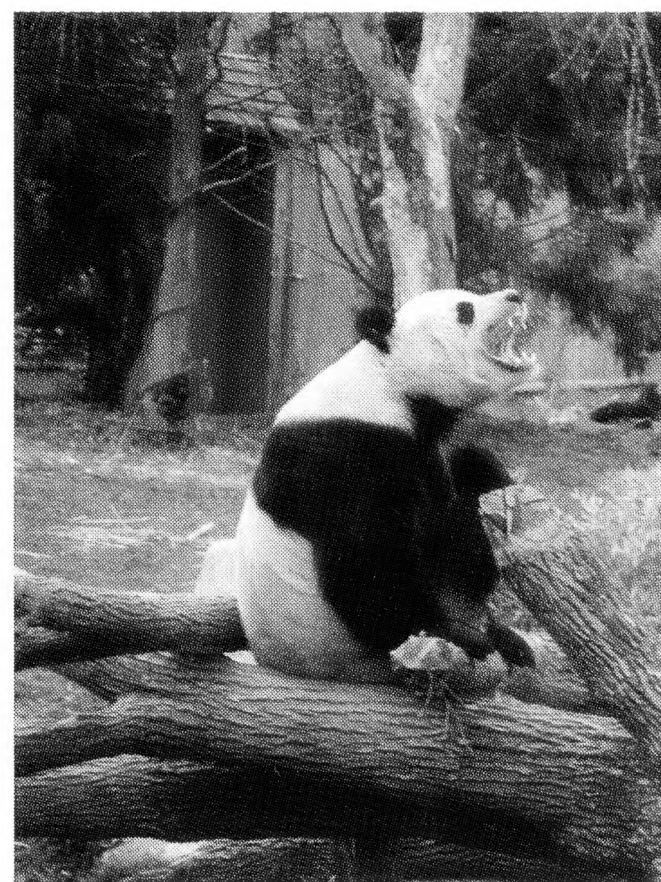
"Red Panda"

The first-place adult color winner is Lance Gwennap from Fairfax, Virginia.



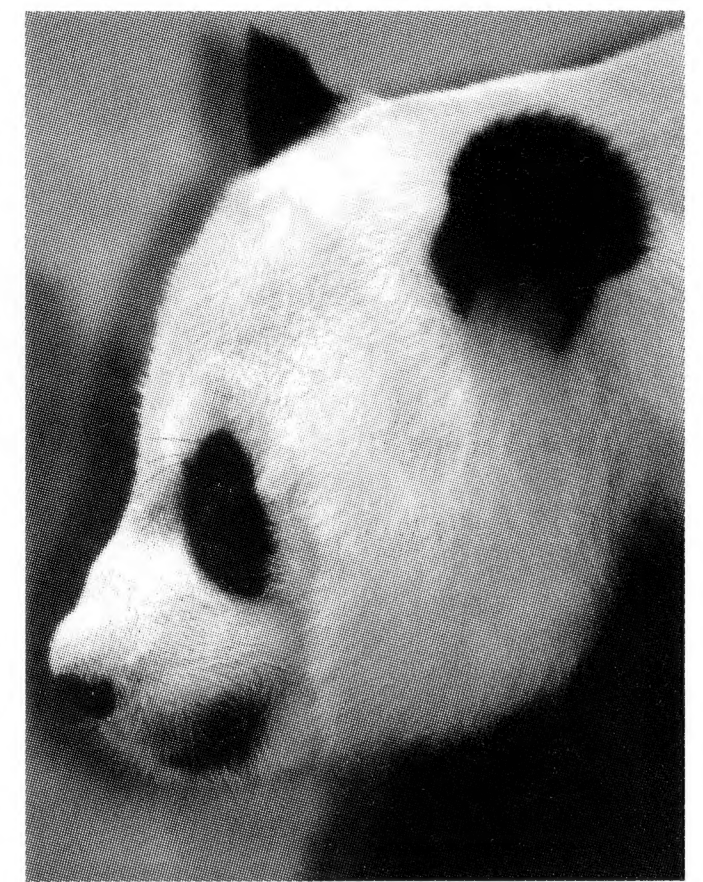
"I swear, I just woke up pregnant!"

The first-place best caption winner is Steve Fine of North Bethesda, Maryland.



"I scream, you scream, we all scream 'hooray' for the National Zoo!"

The first-place junior winner is nine-year-old Bevyn Mannke from Glen Mills, Pennsylvania.



"Lost in Thought"

The first-place adult black-and-white winner is Deanna Escobar from McLean, Virginia.





Zazi cleans one of her five cubs. She and another female, Tumai, bore the first two litters of cheetah cubs at the National Zoo since it was founded. Both are attentive and nurturing first-time mothers.



# CONCEIVING A FUTURE FOR Cheetahs

BY PHYLLIS MCINTOSH

In the wee hours of November 23, 2004—the day before Thanksgiving—head cheetah keeper Craig Saffoe sat alone in his office at the Smithsonian's National Zoo, staring nervously at a video screen. On it, he watched live images of Tumai, a four-year-old female cheetah (*Acinonyx jubatus*) that had been refusing her food, pace agitatedly around her enclosure. These are classic signs of an impending birth, but, like all female cheetahs, Tumai gave few outward indications that she was having contractions. It's a vulnerable time for a mother-to-be

and her unborn cubs, Saffoe says, and loud vocalizing or other obvious birthing behavior could attract predators.

Suddenly, at 2:15 a.m., Tumai stood up, almost as if surprised, and started nudging something on the ground. Saffoe watched anxiously for a few moments until she lifted her head and he spotted a tiny cub wriggling around. Over the next nine hours Tumai, a first-time mother, gave birth to three more healthy cubs—two males and two females in all—the first cheetahs born at the National Zoo since it was founded in 1889.







Jessie Cohen/NZP

**For cheetah cubs, playtime is also a time of learning. Games of running, pouncing, and dodging teach the cubs how to escape predators they would encounter if they lived in the wild.**

As if this were not exciting enough, just five months later three-year-old Zazi, also a first-time mother, gave birth to five healthy cubs, two males and three females. A sixth cub was stillborn. The Zoo's population explosion accounts for about 20 percent of all cheetahs born in North America since the beginning of 2004. But most impressive of all, the nine cubs are thriving and being successfully reared by their mothers—no small feat for a species that in zoos is prone to difficulties at every stage of the reproductive process, from mating to mothering.

These cheetah moms make it look easy, but their breeding success is the result of years of painstaking research into the biology and management of cheetahs, much of it pioneered at the National Zoo. While both Tumai and Zazi mated with males at the Zoo, the Zoo's reproductive physiologists are poised to take the next step: determining how to use assisted breeding technologies such as artificial insemination and in vitro fertilization to help maintain a stable captive cheetah population.

Once plentiful throughout the Middle East and South Asia, cheetahs are now found only in Africa and in small pockets in Iran. Threatened by habitat loss, disease, and conflicts with humans and other animal predators competing for the same limited space, their numbers have dwindled to an estimated 12,000 to 15,000 in the wild. A healthy zoo population is essential to educating the public about these fascinating creatures—the fastest mammals on land, capable of reaching speeds of about 65 miles an hour—and the importance of protecting them in the wild.

Cheetah numbers have dwindled to an estimated 12,000 to 15,000 in the wild.

## Notoriously Difficult to Breed

The Zoo's Cheetah Conservation Station exhibit, which opened in 1992, was designed as a breeding facility, and the Zoo has been actively trying to breed the cats since 1999. At that time, many zoos faced the same challenges: getting cheetahs to mate and then determining why females that had mated did not conceive.

At first the low reproduction rate was blamed on the males, which were known to have very high rates of abnormal sperm, most likely because of inbreeding that followed a catastrophe some 10,000 years ago when the cheetah population may have dropped to just a few animals or perhaps even one pregnant female. But further study revealed that wild cheetahs were reproducing just fine despite the faulty sperm; the males were off the hook.

"We started focusing on the females and found that many were not regularly going into estrus," says Zoo reproductive physiologist JoGayle Howard. If two females are housed together and are not compatible, one will cycle and the other will shut down. Because signs of incompatibility are subtle—perhaps just a few hisses and growls—the Zoo has housed females

separately since the Cheetah Conservation Station opened.

Other management techniques also proved critical in encouraging the cats to mate. Zoos looked at studies of cheetahs' behavior in the wild for clues to facilitating successful mating in zoos. In the wild, adult males (usually brothers) live in coalitions of two or three individuals and defend a single territory as a group, while females are nomadic and completely solitary except when they have a litter, Saffoe explains.



And females decide when and with which males they will mate. When a female is in estrus, she enters the males' territory only when she is ready, and she also determines how long she waits for the males to come and find her. "In zoos we have historically tried to choose when we want females to breed and who we want them to breed with, and that does not work with cheetahs," says Saffoe. "Once zoos started paying attention to the behavior and biology of cheetahs and listening to what they were telling us, we started getting successful births."

Unlike domestic cats, which moan, spray, and roll when in heat, female cheetahs exhibit few outward signs when they are ready to mate. Chemical changes in a female's urine are one of the few indicators, and the scent of a female's urine signals to males that she is in estrus. When the Zoo wants to breed a female cheetah, keepers give her a few days to saturate the ground in an enclosure with her urine, and then introduce a male into the yard. "We wait for the males to tell us the female is in estrus," says Saffoe. If the time is not yet right, the male may just walk around, sniff, and lie down. But if the female is in estrus, "it's like someone flicked a light switch," Saffoe says. The male chirps, yelps, and runs around the yard. If the female is then allowed into the adjacent yard, he usually starts stuttering, a low throaty sound like a pigeon cooing, which is a direct solicitation to the female to mate.

While the males make their intentions well known, the females' signs of interest are much subtler, Saffoe says. If the female raises her tail and exposes her genital area, or lies down and starts rolling, she may be willing to mate. But even those behaviors are not foolproof indicators. "The trick is in knowing whether she's rolling because she's interested in mating or because her back itches," says Saffoe. "We have to spend a lot of time looking at those signs and learning to interpret them."

Before Tumai's and Zazi's pregnancies, there were nine natural matings at the National Zoo. Two females also were artificially inseminated via a method developed by Howard in which a thin rod called a laparoscope is inserted through a tiny incision in the cheetah's abdomen to deposit semen directly into the uterus. Throughout North America, this method has achieved a 45 percent pregnancy rate and produced 19 cubs since the early 1990s. But with the National Zoo's cheetahs it failed.

Over and over, hopes were dashed when signs of pregnancy proved to be false alarms. Once a female cheetah has mated and ovulated or been artificially inseminated after a hormonally induced ovulation, her body switches into pregnancy mode. Hormones rise tantalizingly for about 60 days—two-thirds of the way through the normal gesta-

tion period of about 90 days—then drop if the cat is not pregnant. Because cheetahs excrete the hormones used to determine if they are pregnant in their feces rather than their urine, confirming a pregnancy is a complicated process. Fecal samples must be collected up until about 70 days after mating to make sure hormone levels are accurately reflected. The samples must be dried in a giant vacuum freezer for about two weeks, then sent to the hormone lab at the Zoo's Conservation and Research Center (CRC) in Front Royal, Virginia, and the results reported back to the Zoo, which takes another week. By the time keepers get conclusive test results, months of uncertainty have elapsed, and the gestation period is nearly over.

Why weren't the Zoo's cheetahs conceiving? The females were housed separately and were cycling and breeding, so management was not the problem. "Age was the only thing we could think of," says Howard, so she and Jack Grisham, the Zoo's associate curator

and coordinator of the cheetah Species Survival Plan, analyzed data on cheetah births at other facilities back to 1970. They found that the majority of births, whether from natural mating or artificial insemination, occurred in females between the ages of three and eight. Fertility dropped significantly between ages six and eight, which explained the failures in the Zoo's cheetahs, all age seven or older. Tumai and Zazi, both of prime breeding age, arrived from other zoos in spring 2004, and a year later the Zoo had two litters of cubs.

During those pregnancies, keepers learned that an animal's weight may be as reliable a sign of pregnancy as fecal hormone tests and can yield results more quickly. "Weight follows the same pattern as the hormones,"

Saffoe says. Up to 60 days after mating, females gain weight, and in each false pregnancy their weight has dropped between 60 and 70 days after mating, Saffoe says, noting that "what made us relatively certain Tumai was pregnant was that her weight shot up after day 60." Zazi followed the same pattern.

## Cheetah Parenting

Conceiving and giving birth are just the first hurdles. Cub rearing does not always come naturally to cheetah moms, which incidentally get no help whatsoever from the cubs' fathers.

"What is astounding about these litters is that all the cubs born alive have survived," Saffoe says. "There's a huge potential for at least one cub to die or be neglected or for something to go wrong. It's phenomenal to have nine healthy cubs that the moms attend to just fine." Zazi is such a good mother that she even cleaned and moved her stillborn cub as though it were part of the living litter.



Jessie Cohen/NZP

Tumai's cubs are almost full-grown.



Saffoe attributes part of the mothering success to good natural instincts and the fact that both Tumai and Zazi were reared by their mothers rather than by humans. But the Zoo can take some credit as well. Keepers decided long ago that, if possible, they would adopt a hands-off policy during the first few weeks to allow mother and cubs to bond. To avoid imprinting the newborns with human scents or inadvertently transmitting diseases that their undeveloped immune systems could not fight, even the Zoo's veterinarians did not handle the cubs until they were four weeks old.

Peace and quiet are also essential to mothering success, the Zoo staff believes. "The cold, hard fact is that it's not terribly uncommon for cheetah mothers—or any carnivores—to destroy their young," Saffoe explains. "The statistics are probably a little higher for cheetahs, because they're very sensitive animals and easy to scare. Anything from a thunderclap to a truck driving by to a door slamming could make the mother snap and turn on the nearest thing to her." To avoid disturbing or startling the new mothers, the entire Zoo mobilized to limit staff and volunteer access to the cheetah enclosures and to reduce public traffic on the walkway in front of the nursery yard. Trash collectors help keepers take waste out to the roadway, so trucks don't have to come too close to the yards.

### The Cubs' Future

In the wild, cheetah cubs stay with their moms for about 18 months. After the mom and cubs separate, siblings remain together for per-

**The National Zoo hopes to build a cheetah breeding facility at its Conservation and Research Center, to increase the zoo population of the species.**

All of these efforts are directed toward one end: saving cheetahs in the wild.

haps another six months until they approach sexual maturity. The females then go off to live alone, while brothers usually form a permanent coalition, find a territory, drive off any other male cheetahs they find there, and stake it out as their own.

In zoo environments, cheetah cubs don't need to perfect the same hunting and survival skills their mothers would teach them in the wild, so separation occurs earlier, usually when the cubs are between nine and 12 months old. When keepers notice that mom is vocalizing less and lying farther and farther away from the cubs, they will remove her for an hour or so at first, then for longer periods until the separation is complete. Once they see a similar separation occurring among the cubs themselves, the females will be housed independently, and

brothers will likely stay together as a coalition wherever they go.

By age two most, if not all, of the cubs likely will be sent to other zoos. The Cheetah Conservation Station is currently filled to capacity, and the Zoo will want to breed Tumai and Zazi again because they have a proven track record.

Ultimately, the cubs' fate depends on recommendations from officials of the cheetah Species Survival Plan (SSP), a cooperative management program among zoos that collectively house the 300 cheetahs in North America. The goal of the SSP is to move animals and manage breeding to ensure the greatest genetic and age diversity possible within the population, says SSP coordinator Jack Grisham. Every 18 to 24 months, the SSP surveys zoos with cheetahs, ascertains their needs, and writes a master plan that makes recommendations on moving cheetahs from one facility to another. "We'll probably make recommendations this winter on where our cubs go," says Grisham.

### The Future of Cheetah Conservation

In hopes of expanding its cheetah program and giving more cats the space and seclusion they need to reproduce successfully, the Zoo is designing and seeking funding for a state-of-the-art breeding and research facility at its Conservation and Research Center. Planned to comfortably hold at least 14 cheetahs, the new quarters ideally would become one of several regional facilities where the bulk of captive breeding would take place, says assistant curator Tony Barthel.

Some cheetahs would remain at the Zoo's Rock Creek facility to educate the public about cheetahs and the Zoo's conservation efforts on their behalf, Barthel notes. As for future cubs being on exhibit at the Zoo, Barthel says he would be "very interested in exploring" whether a pregnant cheetah or mother with young cubs could be safely moved between facilities. "We do know what kind of breeding facility we need to build at the Conservation and Research Center, we know how to manage the cats, and if we can get the new facility built quickly enough, we know how to fill it with cats," he adds.

The long-term future of the population of cheetahs in zoos depends on continued research into the basic reproductive biology of cheetahs and ways to assist breeding for greater genetic diversity and



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an increased population in the species. In the mid-1990s, Howard and other National Zoo scientists, working with scientists from other institutions, used artificial insemination with fresh semen to achieve a total of seven cheetah pregnancies at three facilities in Texas and Michigan. After those successes, Howard and a team of Zoo scientists traveled to Namibia, the southern African nation with the largest wild cheetah population in the world. There they showed they could safely catch wild cheetahs and anesthetize them to collect semen for freezing. The team then worked with the cheetah SSP to select females in U.S. zoos for insemination with the frozen Namibian sperm, an effort that resulted in three pregnancies, one in Florida and two in New Mexico.

Once laparoscopic artificial insemination proved successful with both fresh and frozen sperm, Zoo cryobiologist Budhan Pukazhenth took the lead in developing new methods of freezing and banking cheetah semen for future use. Reproductive physiologist Adrienne Crosier continued the work between 2002 and 2005 at the African headquarters of the Cheetah Conservation Fund (CCF), which works to protect cheetahs and their habitat in Namibia.

Using non-releasable resident cheetahs at CCF as sperm donors, Crosier further perfected freezing techniques and then began collecting samples from wild-caught cheetahs that were brought in for medical examination and treatment before they were released back into the wild. In the three years she worked at CCF headquarters, she banked 140 sperm samples from about 60 wild-born animals and taught her African colleagues at CCF how to carry on with the project after she left. The collected sperm is part of the Genome Resource Bank at CCF, which stores genetic material from cheetahs as a precaution against catastrophes such as an epidemic that would wipe out much of the population. As Zoo scientists have shown, frozen sperm from wild cheetahs also can be used to enhance the genetic diversity of cheetahs in zoos.

Over the next few years, National Zoo scientists will study aging in female cheetahs and explore the potential of in vitro fertilization

for allowing older females to reproduce. Almost half of the females in North American zoos are over eight years of age, and many of them have never reproduced. "We want to salvage their genes. But nobody has ever looked at things like menopause in a cheetah, or indeed

in any carnivore," says Crosier. Zoo scientists will investigate whether eggs from older females are viable, or whether, as with women over 40, there are problems with uterine health or fetal abnormalities in older female cheetahs.

Researchers will use ultrasound and laparoscopy on older females to examine the ovaries and uterus and will collect eggs to study their quality. "Older cats may have uterine cysts that would prevent a fertilized egg from im-

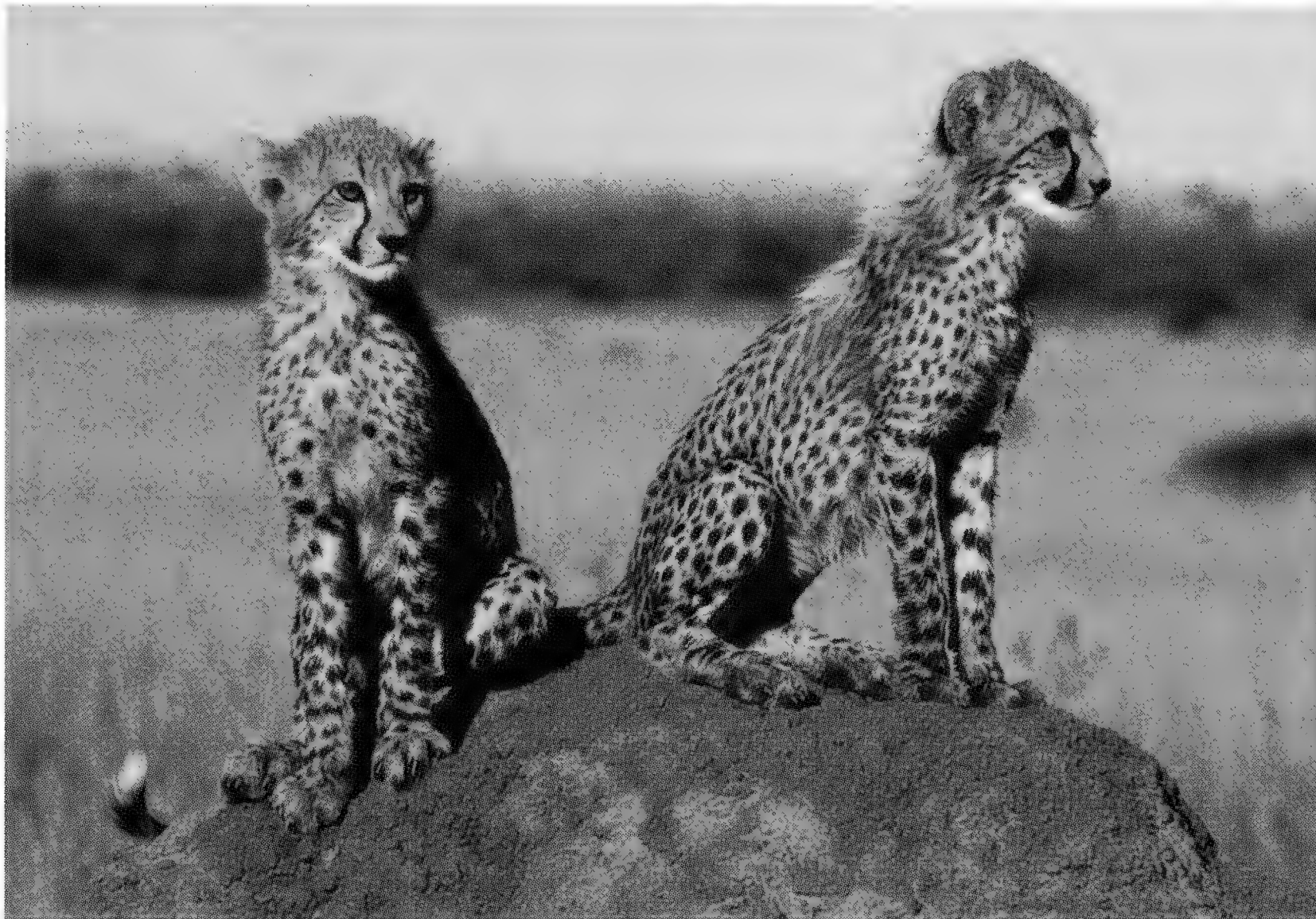
planting," says JoGayle Howard, "but if we're able to get embryos through in vitro fertilization, we could freeze them or transfer them to a younger cheetah and get some representation from those older females that are genetically valuable but have never reproduced."

All of these efforts are directed toward one end: saving cheetahs in the wild. "The best way to ensure that fewer people contribute

to the destruction of the wild population is to bring cheetahs near and dear to people's hearts," says Craig Saffoe. He believes that seeing cheetahs at zoos educates people about their plight and helps them understand how cheetahs are an important part of the world around us. But the future of cheetahs in zoos rides on the success of zoo breeding programs. "The only way to guarantee that cheetahs will be in zoos for the long-term is by breeding them in zoos," says Saffoe, who notes that the Zoo does not remove cheetahs from the wild for its breeding programs. "We want to make sure that generation after generation is able to learn about these beautiful animals and to appreciate them the way we all do." Z

—Phyllis McIntosh is a freelance writer and a volunteer interpreter at the Cheetah Conservation Station.

To contribute to the National Zoo's Cheetah Fund, please visit [www.fonz.org/cheetahfund.htm](http://www.fonz.org/cheetahfund.htm).



National Zoo scientists collaborate with African scientists in Namibia to study cheetahs in the wild.



National Zoo cheetah keeper Jennifer Spoten holds a cub during a routine vet exam.

Jessie Cohen/NZP





Once the source of a bitter border dispute between Ecuador and Peru, the Cordillera del Condor region may become an international peace park that symbolizes the countries' recent collaboration and commitment to conservation.





# CONSERVATION

## *Straddles the Line*

BY HOWARD YOUTH

A river runs through it. And once, so did much enmity and a fair bit of blood. For more than 150 years, South American neighbors Ecuador and Peru quarreled and battled over 48 miles of rainforest and river cloaking an ambiguous border between the two countries, in a remote region called the Cordillera del Condor. Military conflicts over the land erupted in 1941, 1981, and again

in 1995. Finally, in 1998, the two nations signed a peace treaty and established a definitive political border. Boundary markers now dot Cordillera del Condor's soggy rainforest soil, and many land mines have been removed. Today the hope is that instead of dividing the countries, this lush border area will become a collaborative peace park, a shared protected area.



**A**s illustrated by Ecuador and Peru, lines that divide can also bring neighbors together. For this reason, peace-nurturing border parks are now a hot topic worldwide. "Border parks offer opportunities for cooperation between countries that often have few lines of communication due to past or present conflicts," says Charles Besançon, a conservation planning consultant working with the World Conservation Union and World Commission on Protected Areas' Transboundary Protected Areas Taskforce.

Conservationists like Besançon see more than fence-mending opportunities at country boundaries—they also see some of the best remaining chances to save wildlife and wild places. "Conservation seems to be a relatively easy subject for discussion among nations and can be a catalyst to further cooperation in other realms," he says.

But while it's easy to paint a blocky green border park on a map, it's something quite different to secure one on the ground, especially in remote border areas that often shelter poachers, drug runners, bandits, refugees of war and those who prey upon them, and slash-and-burn settlers trying to make a living.

Besançon has catalogued 188 border parks dotting the world map. "They run the whole gamut of examples, from parks set up to increase tourism to those promoting peace and cooperation to those targeting biodiversity conservation," he says. "Many of these internationally adjoining protected areas are in developing nations with barely enough money to support their own parks, let alone deal with the negotiations, security issues, and activity at many different levels of government [that are necessary for peace parks]. Few exist that can truly be called 'peace parks' where peace and cooperation are explicit objectives," says Besançon.

### First and Future Peace Parks

The peace park concept blossomed in 1932 along the 5,000-mile border between the United States and Canada. There, between Montana and Alberta, two national parks joined: Montana's Glacier National Park and Alberta's Waterton Lakes National Park melded into Waterton-Glacier International Peace Park. Peace park organizers, including Rotary International, wanted the park to celebrate

close friendship between the two countries and provide an example of cooperation that could serve as a model elsewhere in the world. While Glacier's one million acres are managed by the U.S. National Park Service and Waterton's 130,000 acres by Parks Canada, the two agencies cooperate in various ways to maintain an expansive, mountainous ecosystem. Park staff often hike visitors to the border, where American visitors sit on the Canadian side and Canadian visitors on the U.S. side. The park superintendents make a tradition of hiking together each year.

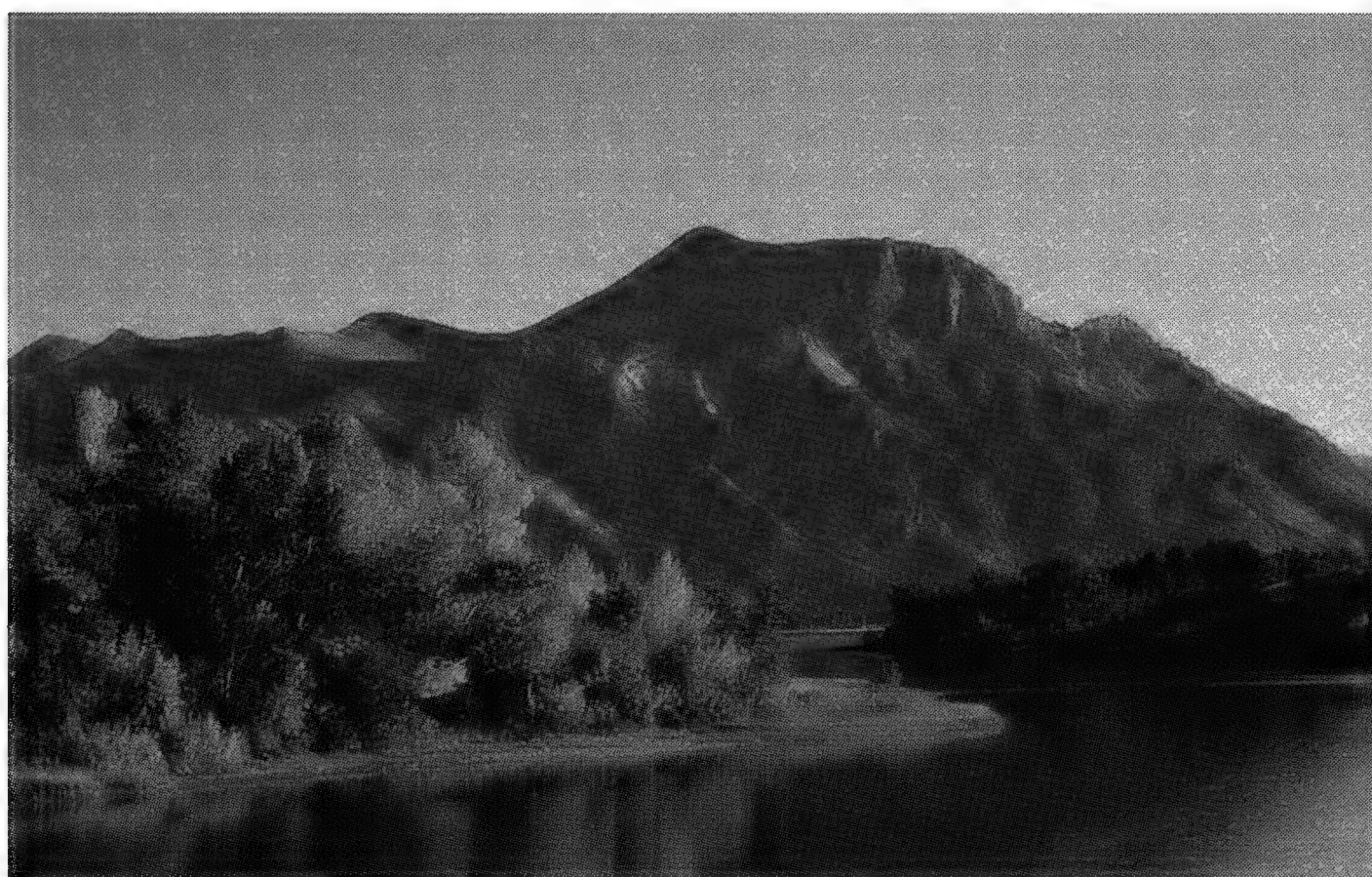
Ecuador and Peru hope to share a similar friendship some day, while protecting borderland wildlife and spurring sustainable development in the Cordillera del Condor. Allies and international organizations including the World Bank, Conservation International,

Ecuador's Fundación Natura, and the International Tropical Timber Organization are helping with the peace park plans. Several parks already join at the border, but more are in the works. "In the case of the part developed in Peru, a proposal has been made for the creation of a national park embracing a large part of the frontier region. This area is approximately 370,500 acres in extent," says Martín Alcalde, Conservation International's director for the Condor region. "The proposal is well advanced and it's hoped that in the coming months the Peruvian [government] will officially declare this park."

Recent surveys found the Cordillera del Condor chock full of biodiversity. Some animals occur nowhere else, among them a localized subspecies of the long-haired spider monkey (*Ateles belzebuth belzebuth*). Despite the surveys, the area remains poorly studied, so it's hard to know how many endemic species truly live there. Scientists have only scratched the surface, a fact hinted at by this summary, which appeared in the 1998 book *Endemic Bird Areas of the World: Priorities for Biodiversity Conservation*: "This area of southernmost Ecuador and northern Peru has only recently been explored; thus, five of the six endemics [endemic bird species] have been discovered since 1975, and [the other] was first found in 1963."

Large mammals such as mountain tapirs (*Tapirus pinchaque*), jaguars (*Panthera onca*), and manatees (*Trichechus inunguis*), and large birds such as harpy eagles (*Harpia harpyja*) and macaws (family

The peace park concept blossomed in 1932 along the 5,000-mile border between the United States and Canada.



**Maskinonge Lake on the Canadian side of Waterton-Glacier International Peace Park.**

Bruce Coleman Inc./Erwin & Peggy Bauer

*continued on page 19*





A private park in the Cordillera del Condor region would preserve ecosystems such as the sandstone meadows and shrublands pictured above, and protect rare species such as the jaguar (below left) and a local subspecies of long-tailed spider monkey (below right).





# CHAIN OF DREAMS

## *The Mesoamerican Biological Corridor*

A proposed Central American wildlife corridor would include the 5.5-million-acre Selva Maya ecosystem (left) and preserve habitat for species such as the Baird's tapir (right).



Central America forms a tapered transcontinental bridge, or isthmus, where raccoons, coyotes, and white-tailed deer meet spider monkeys, tamanduas, and ocelots. One of the world's most ambitious international conservation efforts—the Mesoamerican Biological Corridor—might someday span this connection between North and South America and protect a large slice of biodiversity in a densely populated region.

Under the corridor plan, governments and conservation organizations of eight nations—Mexico, Guatemala, Belize, Nicaragua, Honduras, El Salvador, Costa Rica, and Panama—work together and with international organizations to set up a linked system of conservation areas. Since 1997, their goal has been to protect and connect large remaining wilderness areas, from southern Mexico to Panama's border with Colombia. Such areas include the Selva Maya, or "Maya Forest," 5.5 million acres of protected habitat in Mexico, Belize, and Guatemala. This jewel in the corridor's crown is home to the most expansive tropical forest and largest remaining jaguar (*Panthera onca*) population north of Amazonia.

The Mesoamerican Biological Corridor plan provides the best opportunity to protect rare and declining wildlife that require large areas of habitat, including Baird's tapirs (*Tapirus bairdii*), harpy eagles (*Harpia harpyja*), great green (*Ara ambigua*) and scarlet (*A. macao*)

macaws, pumas (*Puma concolor*), and jaguars, as well as thousands of other species.

As a concept, the corridor gets a lot of attention. Implementation, however, lags behind. Since the plan's inception in 1997, up to \$200 million in international funding has come in, yet few parks and staff have been added.

While the green plans plod along, Mexico and Central American nations are also kindling ideas for a large industrial network called the Puebla-Panama Plan to spark industry and commerce between the nations via highways, power lines, communication networks, and other infrastructure. On the map, the industrial corridor broadly overlaps the Mesoamerican Biological Corridor, leading some to question how tranquil a marriage will be between wildlife conservation and large-scale economic development. Will it prove to be the ultimate contradiction or a plan for success?

"These things ought to complement one another—the money-generating economic corridor and the life-sustaining green corridor can and should be mutually supportive," says Archie Carr III, senior conservationist at the Wildlife Conservation Society. Carr has worked on the biological corridor program since the early 1990s. While not fully satisfied with its progress, he believes it shows great promise for people and wildlife. "It's still alive. It captures people's imagination, both civilian

and governmental," he says. "You see the governments rally around it. That tendency has lingered for many, many years."

But Carr and others believe there is no time to lose. "What jumps out at you in Central America are the mountains," he says. "They stretch virtually the length of the isthmus. Those are steep mountains. When you try to farm them, you put people and water supplies in jeopardy. If you skin these mountains too much, you'll get a devastated environment and society. [Central Americans] have to protect the mountains. It's not just some conservation plea—societies require it," says Carr, who fears that Central America's highlands might someday be stripped bare like those in Haiti, where deforestation exacerbated extreme poverty, destroyed lush woodlands and invaluable watersheds, and left behind useless, barren land.

While neither the Mesoamerican Biological Corridor nor the Puebla-Panama plans have progressed very far, both continue to have the strong support of the Mexican and Central American governments and international donor organizations. "I see it as a race," says Carr. "By the time Central American countries reach a comfortable standard of living, will large places like the Selva Maya be just small, little pieces? That's what we're looking at."

—Howard Youth



Psittacidae) thrive in parts of the Cordillera del Condor. But these creatures and their habitats are not likely to survive this century unless governments and local people work together to secure protected areas and begin sustainable activities, such as compatible small agricultural projects and selective, certified logging. Why such urgency if the region is so out of the way? Because, as with so many once-remote spots, humanity is surging forward. Areas at the edge of the frontier are already being cleared for cattle ranching and slash-and-burn farming. Roads, which are pathways to large-scale clearing, are beginning to snake into the forest.

### Dangers on the Borderline

Protecting and managing large parks with small budgets is a major challenge elsewhere in South America. This is certainly the case in Venezuela, where a number of parks hug the country's volatile border with Colombia. A 2003 report by Venezuela's national parks authority reported that "problems in El Tamá and Sierra de Perijá national parks are associated, generally, with the presence of Colombian guerrillas, smugglers, illegal immigration, kidnappings, drug growth and traffic," among other things. Heavily forested and mountainous, El Tamá National Park has few roads and a handful of staff members who must each keep an eye on thousands of acres. Although Colombian parkland sits on the other side of the border, no binational management plan exists. This is hardly surprising, considering the ongoing conflicts between the military and guerrillas in remote parts of Colombia, but it leaves the park's imperiled wildlife, including spectacled bears (*Tremarctos ornatus*), at risk and protected only on paper.

Even the best-staffed wild areas in the world face challenges protecting their border parks and boundaries. In the United States, security efforts have been stepped up along the entire frontier between Mexico and the U.S.—nearly 2,000 miles—since September 11, 2001. Consequently, there is increased vigilance for terrorist activity, drug trafficking, and illegal immigration in U.S. national parks on the border, including in Texas' Big Bend National Park and Arizona's Organ Pipe Cactus National Monument.

"Protecting national parks along the Mexico border is no longer about simply protecting landscapes, plants, and animals," said Big Bend National Park Superintendant Frank Deckert before a House Government Reform Subcommittee in 2003. "In 2001," he said, "the U.S. Border Patrol estimated that 250,000 undocumented aliens entered the country through parklands with over 200,000 through Organ Pipe Cactus National Monument alone. The...impacts from these human and vehicular intrusions is already causing serious damage to park resources. Here in Texas, similar border security problems are just beginning and multiplying exponentially."

Border crossings in many parks have been shut down in an effort to channel international traffic to the most secure areas. Despite tensions along the Mexico-U.S. border, there is still talk of someday establishing a peace park between Big Bend and a Mexican natural area just across the Rio Grande.

### Border Conservation: Super Size It

Following years of civil war and ethnic strife, leaders in southern Africa are celebrating peace at their borders in a monumental way. They secured a huge, multi-nation peace park along the borders joining South Africa, Mozambique, and Zimbabwe. The Great Limpopo Transfrontier Park is Africa's largest wildlife reserve; it spans 13,500 square miles, an area larger than the size of Belgium. Security fences are coming down 13 years after a cease-fire was called in Mozambique's bloody civil war, enabling smoother communication between neighbors

and safer passage for wildlife that freely roamed across political boundaries before war made doing so dangerous or impossible. The 10,000 African elephants (*Loxodonta africana*) packed into South Africa's Kruger National Park, which is believed to have carrying capacity for only 7,000, have a chance to disperse into a larger area now that the borders are open to them, which could reduce stress on the overtaxed ecosystem. Ten white rhinos (*Ceratotherium simum*) and several large antelopes already have been relocated from Kruger to the Mozambique side, where many easily targeted mammals were wiped out by

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Even the best-staffed wild areas in the world face challenges protecting their border parks and boundaries.

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Spectacled bears in the parks on the border of Venezuela and Colombia suffer from violence between guerrillas, smugglers, and the military.

J'nie Woosley/NZP





**International discord can be both an obstacle and a boon to conservation. On the border between Rwanda and the Democratic Republic of the Congo, conservationists had to surmount political strife between the countries to protect habitat for endangered mountain gorillas (left), whereas the feud between North and South Korea gave rise to a demilitarized zone in which white-naped cranes (right) and other species thrive in the absence of development.**

poachers and those seeking to feed hungry armies during the years of bloodshed there.

Such gigantic protected areas often encompass not only wildlife habitat, but also villages and towns. Border areas often house the most disenfranchised—those living farthest from capitals and commercial centers—many of whom are poverty-stricken or are refugees of war or ethnic conflicts. Creating a park in these people's backyards could further disrupt fragile communities. "If you have people living on the edge, relying upon natural resources for their livelihoods, the establishment of a strictly controlled national park can put further stress on them by removing opportunities for hunting and for gathering plants," says Besançon. In addition, decisions on land-use practices for the parks are sometimes moved from the local arena to distant government centers, where local concerns may not be heard.

In the case of the Great Limpopo, local communities went about their daily lives without realizing they'd been enclosed in park boundaries, while heads of state forged ahead with plans for the park. Government leaders are now trying to remedy this oversight by incorporating local populations into park planning, and giving them opportunities to use resources and set up sustainable businesses. With support for locals—and support from them—the future of the

park and its communities will be far brighter. In Ecuador and Peru, large indigenous communities living in the Cordillera del Condor region have been included from the start in park planning as well as the setup of sustainable development projects.

The Great Limpopo Transfrontier Park started out with presidents shaking hands and discussing plans. Such relaxed, high-level activity is not possible for all border parks. Sometimes cross-border conservation efforts come via a different route. Low-level cooperation has prevailed in the home of the world's 700 remaining mountain gorillas (*Gorilla gorilla beringei*)—the border region between violence-torn Rwanda, the Democratic Republic of the Congo (DRC), and Uganda. While high-level government of-

ficials in these countries were barely talking, lower level conservationists overcame all odds to protect transborder habitats for endangered apes and other wildlife. "This is an example of how transboundary cooperation can transcend ethnic and political bounds," says Besançon. "These countries have had some form of violent conflict going on for years. During the 1994 genocide, Rwandan refugees moved through the parks in the DRC and Uganda. Through all of this, the managers of the parks have been in communication. The park staff are just conservationists doing their jobs. This is remarkable given the animosity between governments and peoples," he says.

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In a perfect world, border parks would exist around the globe, fostering harmony among nations and between humanity and other species.

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African elephants ford a river in the Great Limpopo Transfrontier Park, which straddles the borders of South Africa, Mozambique, and Zimbabwe.

## Bounty at the Barrier

Some potential peace parks were nurtured by barbed wire and land mines. You could call the Korean Demilitarized Zone, or DMZ, a “war park.” Since South Korea signed a truce with North Korea in 1953, this 155-mile-long, 2.5-mile-wide no-man’s-land has become a defacto wildlife sanctuary unmatched elsewhere on the Korean Peninsula. Among its denizens are wildlife species now gone from most or all other parts of densely developed South Korea and severely drained and deforested North Korea, including nesting red-crowned (*Grus japonensis*) and white-naped (*Grus vipio*) cranes, black-faced spoonbills (*Platalea minor*), Asiatic black bears (*Ursus thibetanus*), and perhaps Amur leopards (*Panthera pardus orientalis*).

In an ironic twist, peace between the Koreas could spell doom for the DMZ’s prime wildlife habitat. Over the past few years, South and North Korea have initiated a dialogue, and a road and rail line have opened through the DMZ. Conservation has not been a top priority for either country in years past, so conservationists are clamoring to secure the DMZ’s future as a peace park before it opens to development. “I feel positive that creating a peace park in the Korean DMZ will happen in the foreseeable future,” says Seung-ho Lee, president of the DMZ Forum, a U.S.-based group lobbying for the designation of the area as a peace park. “Although the current political climate is not bright,” says Lee, “we have continuously engaged political leaders of North and South Korea and other

stakeholders to commit to the peace park.” So far, though, the area’s future is anyone’s guess.

In a perfect world, border parks would exist around the globe, fostering harmony among nations and between humanity and other species. “The best thing since sliced bread is what some people would call it,” says Besançon of the idea of transboundary protected areas. “Clearly these things are rising in number and extent. But we need to make sure we’re doing it right. For one thing, it’s an awfully expensive exercise. We shouldn’t jump in without understanding the implications.” These include the realization that peace parks are costly, requiring cooperative park and border security patrols, conferences and formal agreements, and other pricey formalities.

Whether peace parks or other border parks succeed as tools of understanding and biodiversity protection will depend upon whether political leaders, countries, and local people can join forces to listen to one another and collaborate. Anything less may bring about the opposite outcome. Says Besançon, “The goal should be to allow the benefits of protected areas to be shared equally with local people and across borders. Otherwise, we risk creating conflict where none existed before.” Z

—Contributing editor Howard Youth frequently writes on international conservation efforts.





Like the domestic horses pictured here, herds of wild Przewalski's horses once grazed on the steppes of Mongolia and China, but competition from livestock and habitat loss nearly drove them to total extinction. National Zoo scientists are working to return Przewalski's horses (opposite) to their native lands.



# A Spirited Return

BY JENNIFER WINGER

Amid the rippling foothills of the Blue Ridge Mountains in Front Royal, Virginia, 16 descendants of a proud Mongolian lineage help keep their race alive. They live only 75 miles west of Washington, D.C., but a world away from the rugged, semi-arid Eurasian steppes their ancestors once populated.

They are Przewalski's horses (*Equus caballus przewalskii*), a Eurasian species of wild horse that has been hoofing the line of extinction for more than a century. Born and bred on American soil, the nine mares and seven stallions reside at the Smithsonian National Zoo's Conservation and Research Center (CRC), and know nothing of their species' native land.

Herds of Przewalski's horses once roamed from the plains of western Mongolia to the fringes of the Gobi

desert in northern China, and the Altai mountains that trace the border between, lands known for their strong winds and extreme temperatures. However, their hooves have been little heard since the last wild horse was seen in Mongolia in 1969, just north of Tachjin Shar Nuru—the Yellow Mountains of the Wild Horse.



The history of the Przewalski's horse has all the hallmarks of an ecological tragedy. In the early 20th century, farmers and their livestock monopolized good grazing lands and pushed Przewalski's horses into less hospitable territory, while wealthy aristocrats and Western breeders with a yen for the un-

usual sought foals to fill their pastures. Although many Mongolians loved the horses deeply and immortalized them in story and song, the fate of the species in the wild was far from romantic.



Przewalski's horse was declared extinct in the wild in the 1970s, and for decades it has survived only in zoos. With a shallow gene pool plagued by inbreeding, the species stood knee-deep in uncertainty. But now, thanks to a Species Survival Plan (SSP) put into place by the American Zoo and Aquarium Association (AZA), the species is getting a second chance at survival.

These days you do not have to go to Eurasia or even to CRC to eye this exotic equid. No passport? No problem. You can see Minnesota, a 17-year-old stallion and one-year resident of CRC, in his new habitat near the Small Mammal House at the National Zoo in Washington, D.C. And this stocky horse with the stately name is no longer the last vestige of a dying breed, but, rather, a caramel-coated ambassador of a species reborn.

### Voyage of Discovery

In the late 19th century, Przewalski's horses, or takhi as they are known in Mongolia, were reluctant stars. Shy and skittish, the horses have always been an important, if elusive, part of Mongolian society. Takhi means "spirit" in Mongolian, and, like spirits, the horses were seldom seen but often revered. One legend has it that 13th-century warrior Genghis Khan rode a takhi as he led his armies on horseback and into the history books by creating a vast Mongolian empire from Southeast Asia to eastern Europe. Today, takhi are far more common in books, songs, and even rock engravings than on the wind-swept plains where they made their start. And although the domestic horse (*Equus caballus*) provides livelihood and leisure to the 2.7 million Mongols of the 21st century, it is the takhi that hold the nation's heartstrings.

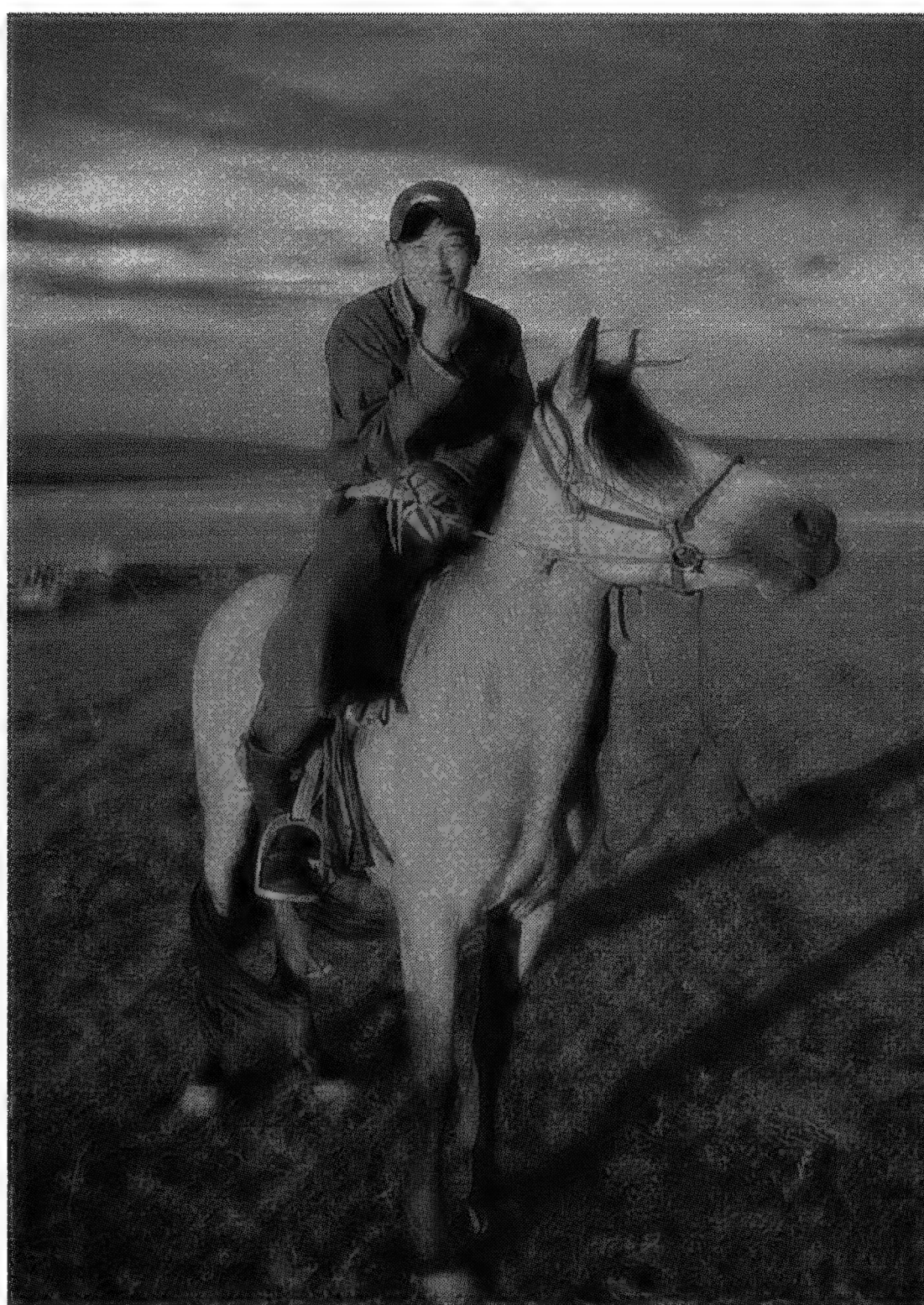
Takhi were not scientifically described until 1881, after a Russian czar sent Polish explorer and naturalist Nikolai Przewalski to investigate whispers of wild horses drifting across Central Asia. Przewalski's first attempt to find the horses was unsuccessful, but when he probed the Asian interior a second time, a Mongolian border guard gifted the explorer with a souvenir skull and a hide. Scientists at the Zoological Museum of the Academy of Science at the University of St. Petersburg determined that the pieces came from a wild horse.

Przewalski's discovery proved that Mongolia had more than just galloping ghosts on its hands. In fact, the country was home to the ancient cousin of the modern-day domestic horse. But even at the

time of Przewalski's expedition, takhi were already living an abbreviated existence. Western European cave paintings and tools decorated with stout horses resembling takhi suggest that the horses occupied large avenues of land on steppes from Spain to China some 20,000 years earlier. But when the Earth began to thaw after the last ice age, Przewalski's horses' semi-arid, treeless habitat gave way to forests. As their habitat shrank steadily in response to climactic changes, the horses lost ground in other ways as well. Competition from humans and livestock whittled away their range until they were confined to small areas in northern China and southern Mongolia.

### Wild Things

Short and muscular, the Przewalski's horse stands about 13 hands high. The flan-colored steed has a two-tone finish with a buckskin



Mongolians ride domestic horses for work and leisure, but it is unlikely takhi were ever ridden.

David A. Seaver

top, a pale underbelly, and a dark eel-stripe that blazes down its dorsal pelage. Depending on the season and individual variation, coat color may range in hue from dun to bay. Its large head is topped by a dark and bristly Mohawk-mane with no forelock, and its muzzle is pale, like its undercarriage. Its forelegs are striped, zebra-style, just behind the knee and on the hocks.

But the Przewalski's horse's most remarkable biological feature cannot be seen with the naked eye. A microscopic look reveals that the Przewalski's horse possesses 66 chromosomes, two more than its domestic cousin, *E. caballus*, which is found on farms and in show rings around the world. Despite this genetic difference, takhi and domestic horses can breed and produce fertile offspring with 65 chromosomes. Many organisms with an odd number of chromosomes are infertile. Take, for example, the mule. A female horse with

64 chromosomes and a male donkey with 62 chromosomes will produce offspring with 63 chromosomes. However, unlike takhi-horse offspring, mules are sterile. Yet the takhi's success in mating with domestic horses could prove detrimental to the species. Although a takhi-horse offspring may look exactly like the wild parent, it is genetically distinct, and with each additional pairing pure takhi genes fall away.

Przewalski's horses' relationship to domestic horses is up for debate, and as such, their taxonomic status is in limbo. Some mammalogists believe that Przewalski's horses are a separate species from domestic horses (*E. caballus*), and use the name *E. ferus przewalskii*.





Wynne Collins/NZP

**A single stallion often controls a harem of females, and must defend them from other stallions in search of breeding mares. Here, a stallion with a dark mane stands at the head of a group of mares at the Wilds of Ohio.**

Others think Przewalski's horses should be classified as a subspecies of the domestic horse, and dub them *E. caballus przewalskii*. Scientists are now attempting to determine whether takhi and domestic horses descended from a single common ancestor, and their findings may one day tip the scales in favor of one scientific name over another.

While the Przewalski's horse's name is being contested, its wild ancestry is not. The lifestyles of many feral equids suggest that the Przewalski's horse is not the only wild horse on the block, but there is a difference in *living* wild and *being* wild. A domestic horse becomes feral when it escapes into the wilderness and procreates with other fugitive horses. Feral populations span the globe, from the mustangs of the western United States, to the ponies that annually swim the channel between the barrier islands of Assateague and Chincoteague off the coast of Maryland and Virginia, to the mobs of brumbies that roam Australia's bush in the Northern Territory and northern Queensland. Despite their diversity, these feral populations all originated from domestic stock and fall under the same scientific name as the domestic horse. Przewalski's horses, however, have never been domesticated, and whether they were born on a steppe or in a stable, they descended from wild populations. They may not be alone in their bid for freedom, but when it comes to wild genes, Przewalski's horses are the only game in town.

Common ancestry may explain why Przewalski's horses behave much like feral horses and some zebras, which also belong to the genus *Equus*. Przewalski's horses live in two distinct social groups—

family and bachelor. The family group consists of ten to 20 females and their foals, led by one stallion. When fillies become old enough to mate, they leave their natal group and join another family band. When colts become sexually mature, they are ousted from the group, and form coalitions with other young bachelors. Competition for mares is tough, and tempers can flare between stallions when one male threatens another male's harem. But a bite here and a kick there can be worth it when breeding partners are at stake. In fact, stallions often use a "snaking posture" to herd their harems and prevent an onslaught from a fellow steed. With a low head and an open mouth, a stallion slinks around his mares, using sometimes-violent behavior such as bite-threats to keep them together and reinforce his position at the head of the pack.

But the horses' behavior is not all rough-and-tumble. They are very social animals and can be affectionate. The most notable example is the takhi grooming ritual, whereby two mares stand side by side and head to tail, and use their teeth to nibble each other's skin. Often, a mare begins by working her way down the back of her partner and on to the hind legs. The horses may pair up with a regular grooming partner or any available nibbler. This reciprocal activity not only keeps the horses clean, but also reinforces the social solidarity of the group.

### Family Matters

Thanks to reintroduction programs in China, Kazakhstan, and Mongolia, several free-ranging herds of Przewalski's horses once again





In Mongolia, Przewalski's horses' habitat is rugged and varies from grassy slopes (above) to rocky cliffs (below); temperatures range from sub-arctic to sweltering. For the first year after they are reintroduced to Mongolia, horses bred in North American facilities will live in an enclosure so scientists can monitor them while they acclimate.





roam the steppes from which they have been long absent. But to enhance the genetic diversity, these populations must be supplemented with horses from North America and Europe, and more reintroduction sites need to be established. For now, National Zoo scientists are focusing on the reproductive habits of the Mongolian horses while the horses are still on American turf, and genetic management is the top priority. Using studbooks—detailed genealogies of the horses' ancestry—as a guide, scientists selectively breed Przewalski pairs to maximize genetic diversity and minimize inbreeding. Currently, the Asian Wild Horse Species Survival Plan, a nationwide effort to study and revitalize this flagship species, provides recommendations that dictate breeding decisions in most North American institutions.

Horses are transferred among the participating facilities to breed according to these guidelines. Last year, however, CRC had plenty of stock to work with. In 2004, no stallions were shipped to the facility because one of its own stallions could be bred with six of seven breeding mares. But despite these odds, not a single mare at CRC became pregnant.

In the face of such statistics, new breeding strategies have become critically important. According to Wynne Collins, an equine reproduction biologist and a trainee in the Zoo's Department of Reproductive Sciences, little is known about the reproductive physiology of the Przewalski's horse or the reasons why it has difficulty reproducing in zoos, although scientists suspect many factors such as age, inbreeding, and nutrition may be behind the problem. With an eye toward the future, scientists at CRC have begun a new research program to determine the source of the mares' low fertility. "We are trying to preserve the species long-term," says Collins. "The captive population is our reservoir for reintroduction sites." And if zoos cannot maintain viable populations of threatened and endangered animals, there is little hope for reintroduction programs in general, and the Przewalski's horse in particular.

The real problem lies in the species' lack of genetic diversity. All Przewalski's horses alive today are descendents of 14 wild horses captured at the beginning of the 20th century. With so few founders, and no new genetic input, it's nearly impossible to create a genetically diverse population.

For years, the SSP struggled to find the best strategy to manage its North American herds. From its beginning in 1979, the Asian Wild

Horse SSP bred Przewalski's horses according to A-line and B-line genetic management strategies. Facilities that subscribe to the A-line strategy only breed Przewalski's horses descended from nine founders at the Munich Zoo in Germany. Currently, only the Munich Zoo and the Leipzig Zoo, also in Germany, endorse the A-line strategy. The B-line strategy took a less conservative approach to genetic management, as it included genes from a domestic Mongolian mare that was bred to a takhi stallion at the beginning of the 20th century. The pairing produced a colt that became a breeding stallion at the Prague Zoo and bred with four takhi mares; these horses are the five founders of the B-line. The B-line strategy is no longer used in any breeding facility.



**Mares' reciprocal grooming is a social behavior.**

Wynne Collins

While North America's Asian Wild Horse SSP tried to manage its animals in two separate breeding populations, Europe formed the Europäisches Erhaltungszucht-Programme (EEP) in 1986, and implemented a mixed-line, or M-line, strategy to manage its herds. M-line breeding is a distinct departure from previous management strategies because it maximizes diversity by incorporating genetic stock from A-line and B-line horses.

In 2004, the Asian Wild Horse SSP got on the right track and adopted the mixed-line strategy as well. Under the direction of Zoo scientist and SSP species coordinator Steven Monfort, all of the Przewalski's horses in North America are now being treated as a single population. A-line horses breed with B-line horses from different facilities across the nation. Zoos can trade reproductively viable animals to increase the genetic diversity of the offspring. With only

150 extant horses involved in the Asian Wild Horse SSP, this small change could have a large impact.

Fortunately, CRC has a hot commodity in this high-stakes game. His name is Frog, and this six-year-old breeding stallion is the most genetically valuable Przewalski's horse in North America. Because his genes are the least represented in the SSP, every mare on this side of the pond wants a date, and six lucky girls are going to get one. Following SSP recommendations, six mares will be moved to CRC in the next breeding season to rendezvous with Frog. With a mean kinship value of 0.143, Frog is related to about 14 percent of the population of Przewalski's horses in North America. A mean kinship value of 1 indicates a relation to all living members of a population, and although Frog's 0.143 is not ideal, it's as good as it gets. In a





Jessie Cohen/NZP

Ultimately, National Zoo scientists' work will help reestablish self-sustaining wild populations of Przewalski's horses.

population of such modest diversity, even a little genetic variation can make a humdrum horse look like a good catch.

In order to make the wildest of the wild genes available to all breeding mares in the North American population, the AZA is considering whether artificial insemination (AI) should be used to genetically manage the species. Assisted reproductive technology such as AI would both swell the ranks of the captive population and improve the quality of the offspring. Also, AI could sidestep the problems many zoos face when trying to house stallions, which can be aggressive, and cannot be kept in the same enclosure. At CRC, for example, seven stallions are housed individually, with each horse habitat flanked by an enclosure containing a scimitar-horned oryx (*Oryx dammah*), which seems to make a more peaceful neighbor. With AI, there would be less need to transport actual horses to produce suitable breeding pairs. Facilities could trade semen rather than stallions. Transporting animals from one facility to another can be tricky business and may result in injury or stress to the horses. Alternatively, AI would avoid the costs associated with transporting the animals and bypass the risk that transported animals may not be compatible with mares or stallions at the destination facility. But AI cannot begin until scientists get a handle on the horses' basic reproductive biology.

In the meantime, scientists at CRC are focusing on the reproductive health of their own herd. By performing ultrasounds on mares at regular intervals, Collins and other scientists can get an idea of what is happening in the ovary and correlate ovarian changes with the hormone levels measured in the mares' urine. Collins hopes this research will shed some light on possible fertility problems within the CRC herds. A better understanding of the semen quality of the stallions and the reproductive cycles of the mares will lead to more pregnancies and foals in the future. Another insurance policy for the takhi's future is cryobiology, the science of freezing living cells. While AI would increase the reproductive efficiency of the zoo population, creating a genome resource bank could guard against disaster among reintroduced horses. Scientists are racing to preserve valuable genetic material from aging takhi, and a bank of frozen cells would allow for genetic exchange among captive, wild, and even deceased horses.

### Long Road Home

Selective breeding is just a part of the SSP's multi-pronged strategy to revitalize the species. About 1,500 Przewalski's horses live in zoos and other research facilities around the world, and, in 1993, reintroduction programs began to return some of these to their ances-



tors' geographic range. In cooperation with the Cologne Zoo and the Chinese Wild Horse Breeding Centre, the National Zoo is assisting with a reintroduction project in the Kalameili Reserve in the northwestern province of Xinjiang, China. But creating self-sustaining wild populations is not an easy task. Acclimating to the harsh habitats of Mongolia and northern China, interbreeding with domestic horses, and potential conflicts with locals are all serious challenges that stand between the wild horses and the wild.

When Przewalski's horses relocate to Asia, they face more severe climates than in North American facilities; summers can be hot, particularly in Mongolia, and winters are subarctic. But the younger the horse, the better the chance of acclimation. Scientists have found that horses under five years old are more able to go with the flow, even if the flow is a high-velocity wind-and-dust storm. Przewalski's horses imported to the steppes will be kept in acclimatization pens for their first year on native soil. This holding pattern allows scientists to observe the horses' free-ranging behavior and intervene, if necessary, to supplement the horses' diet or administer veterinary care.

Interbreeding with domestic horses is also a hazard scientists hope to avoid. Local herdsman bring their livestock through the Kalameili Reserve on their yearly trek between their animals' winter range in the Gurbantongut Desert and their summer range in the Altai mountains. Thousands of domestic horses accompany the livestock on the journey and will come in dangerous proximity to reintroduced takhi living within the reserve. Although scientists acknowledge that few, if any, Przewalski's horses lack genetic input from domestic stock, further introgression of domestic horse genes would only dilute the precious few takhi genes that are left.

Overgrazing is yet another concern. With livestock mowing across the grassy reserve twice a year, there may not be enough food to go around. In an effort to be safe rather than sorry, scientists plan to study the carrying capacity of the Kalameili Reserve by collecting data on livestock densities, seasonal migration routes, and conservation awareness in local communities. Can the Asian habitat support both the reintroduction of its native takhi and the livelihood of its native people? The Zoo is not going to wait and see; instead, scientists will visit local markets to conduct community surveys on hunting and poaching beliefs, assess the livelihood strategies of local

people, and host informative workshops to determine how horse and human can peacefully coexist.

Successful symbiosis will depend on finding a solution that accommodates both the takhi and the herders who live on the Kalameili Reserve's borders. The Przewalski's horse has already been reintroduced to four reserves in Mongolia and Kazakhstan, and the Chinese Wild Horse Breeding Centre has reintroduced about 30 horses to the 4.2-million-acre Kalameili Reserve. According to Peter Leimgruber, a landscape ecologist and conservation biologist at CRC, the EEP and the SSP will send additional horses to the Wild Horse Breeding Centre for release and breeding beginning this fall, to bolster the genetics of the existing Chinese herd.

Despite its precarious plot, the tale of the Przewalski's horse is a conservation success story. And although the road ahead is neither short nor smooth—loss of habitat and genetic homogeny still pose a



A National Zoo scientist watches a mare at CRC.

Jessie Cohen/NZP

threat—it is, at least, the road toward recovery for a species that has had a very long wait. Slowly but surely, the wild horses are returning to the Yellow Mountains of the Wild Horse.

According to CRC's Collins, this is what good genetic management is all about. "The Przewalski's horse is conservation at its best," says Collins. "It is what every conservationist dreams about." Indeed, the future of the species will depend on research and reintroduction, but it may also ride on the wheat-colored withers of a horse named Frog. Z

—Jennifer Winger is a ZooGoer intern and a graduate student at the University of Colorado, Boulder.



# BioAlmanac

by Emily Huhn, Deborah Press, and Jennifer Winger

## Like Mother, Like Daughter

Bottlenose dolphins (*Tursiops* sp.) in Shark Bay, Australia, are keeping their beaks clean and letting sponges do their dirty work. Some Indo-Pacific bottlenoses wear cone-shaped marine sponges on their rostra when they forage on the sea floor. "Sponging" protects the sensitive skin on the dolphins' beaks from hazards hidden beneath the sand.

According to a study published in June 2005 in *Proceedings of the National Academy of Sciences*, sponging is socially transmitted rather than genetically inherited. Because dolphins "watch and learn" instead of relying on instinct, this behavior may be the first known example of material culture in marine mammals. And the females have all the fun—only one out of 15 known adult spongers is male. Genetic analysis of 13 adult spongers and 172 non-spongers suggests that female calves learn the fashionable way to forage from their mothers. —J.W.



## What's in a Name?

A West African proverb advises against rubbing bottoms with a porcupine. Anyone tempted to do the bump with these prickly rodents should heed this warning. If cornered by a predator, porcupines aim their backsides toward the animal and sink raised quills into its skin. Accordingly, the scientific name of the North American porcupine, *Erethizon dorsatum*, derives from Latin and Greek words meaning "irritating back."

The word porcupine translates from Latin as "spiny hog," likely an allusion to the animal's porcine snout. Variations on the word, including "porkpen," "portepoyn," and "porkenpick," abound in Middle and Early Modern English. Shakespeare coined



his own version in Act 1, Scene 5 of *Hamlet*, when the king's ghost raves about agonies of damnation that would cause Hamlet's "hair to stand on end, like quills upon the fretful porpentine."

Although their common names liken them both to pigs, porcupines are not closely related to hedgehogs. Porcupines are mostly herbivorous and belong to the order Rodentia, while hedgehogs are omnivorous members of Insectivora. Hedgehogs are dubbed for their pig-like snuffling and rooting behavior. A male hedgehog is called a boar, a female a sow, and a baby a hoglet, piglet, or pup. —D.P.

## How Do Electric Eels Shock?

Electric eels (*Electrophorus electricus*) are not true eels, although they share similar physical traits, such as long bodies and finless backs. Instead, *E. electricus* belongs to a group of fish called ostariophysians, along with catfish and goldfish.

Electric eels are nocturnal and have poor eyesight, so they use electricity to hunt in the dark and muddy waters they inhabit. Three of their organs produce electricity: the Sach's, main, and Hunter's organs. To navigate currents and locate prey, an electric eel sends out a weak signal of about ten volts from its Sach's organ. When the quarry is found, the eel stuns and immobilizes it with a much stronger signal to the tune of more than 500 volts from the main and Hunter's organs. Once its supper is rendered helpless with shock, the eel swims over and gobbles it up. Electric eels also use electricity to ward off predators and can produce enough voltage to injure humans. —E.H.

## Fact or Fiction: Elephants Never Forget

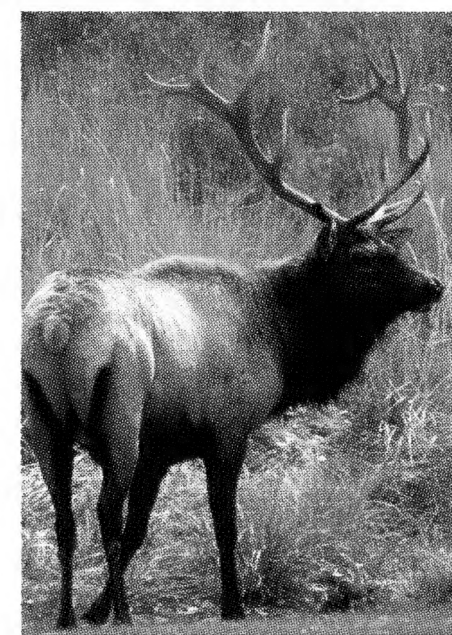
Never is an overstatement, but they do have excellent memories. Elephant brains rank among the largest of all animals relative to their body size. In particular, their temporal lobes—regions of the brain associated with memory—are relatively larger and more complex than those of humans.

Elephants live in matriarchal societies led by a senior female, whose memory is especially critical to the well-being of the herd. She accumulates social memories, allowing her to recognize friends or foes she has encountered in the past. This is no small task—an elephant can make hundreds of acquaintances in its lifetime. The matriarch also recalls migratory routes, the location of food and water sources, and even human acquaintances. Behavioral ecologists give accounts of formerly captive elephants responding to their trainers' voices and commands after 12 years in the wild. —D.P.

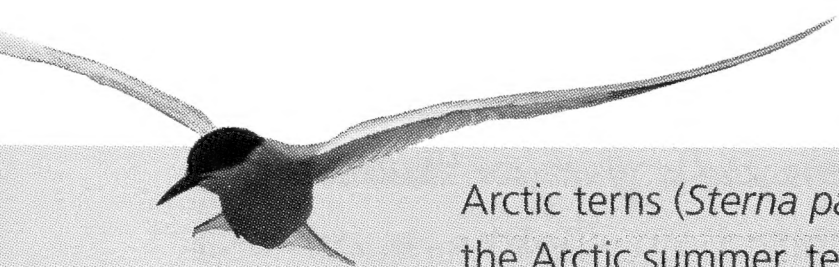
## In Season

In early autumn, the forests of north-central Pennsylvania resonate with the squeals of male elk (*Cervus elaphus*) attracting harems for the breeding season. With his bugling mating call, a male amasses a harem of up to 20 females and challenges rivals to lock antlers for access to them.

Before the 1800s, as many as ten million wild elk roamed most of North America, including parts of Pennsylvania, Maryland, and Virginia. But by the early 1900s, elk were extinct in the eastern United States due to unregulated hunting. Years later, several wild herds were established in eastern states

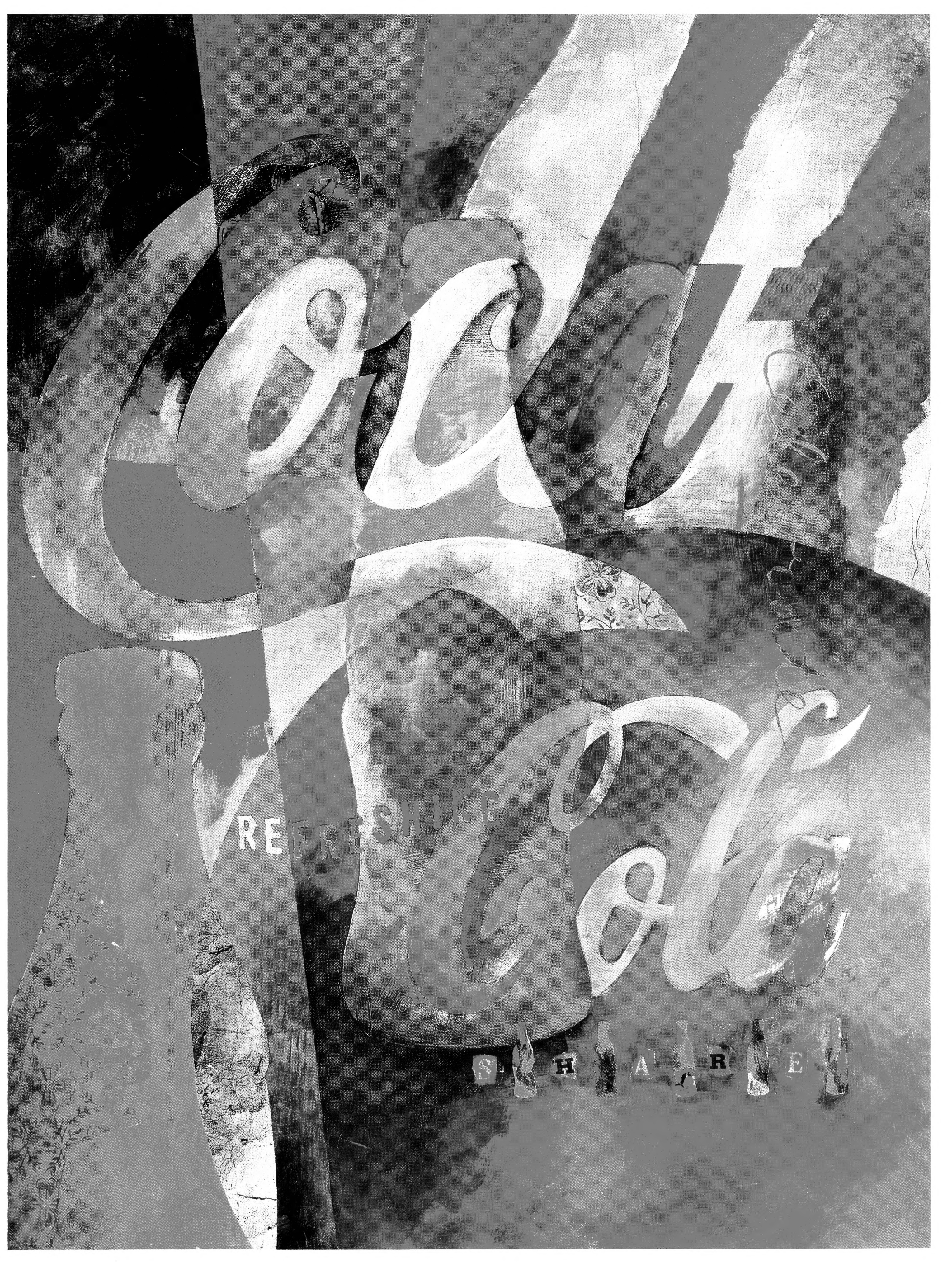


with elk brought in from the West. Elk from Yellowstone were introduced to Pennsylvania beginning in 1913, and the wild herd today includes more than 500 individuals. —D.P.



Arctic terns (*Sterna paradisaea*) see more daylight than any other animal. During the Arctic summer, terns enjoy 24-hour sunlight before migrating 11,000 miles to the Antarctic for a second summer of round-the-clock sunlight. —D.P.





Refreshing

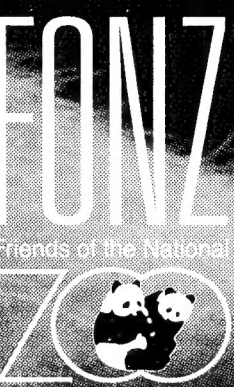
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